INVESTIGATOR'S ANNUAL REPORT

United States Department of the Interior

National Park Service

All or some of the information you provide may become available to the public.

OMB # (1024-0236)
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Reporting Year: 2010	**Park:** Shenandoah NP	**Select the type of permit this report addresses:** Scientific Study

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Project Title (maximum 300 characters):

The Common Raven in Cliff Habitat: Detectability and Occupancy

Park-assigned Study or Activity #:	**Park-assigned Permit #:**	**Permit Start Date:**	**Permit Expiration Date:**
SHEN-00362	SHEN-2009-SCI-0006	Apr 01, 2009	Dec 31, 2010

Scientific Study Starting Date:	**Estimated Scientific Study Ending Date:**
Jan 01, 2009	Aug 31, 2011

For either a Scientific Study or a Science Education Activity, the status is:

Continuing

For a Scientific Study that is completed, please check each of the following that applies:

__ A final report has been provided to the park or will be provided to the park within the next two years

__ Copies of field notes, data files, photos, or other study records, as agreed, have been provided to the park

__ All collected and retained specimens have been cataloged into the NPS catalog system and NPS has processed loan agreements as needed

Activity Type:

Research

Subject/Discipline:

Birds / Ornithology

Purpose of Scientific Study or Science Education Activity during the reporting year (maximum 4000 characters):

Project Summary:

The common raven (Corvus corax) is a cliff-nesting bird species of conservation interest in Kentucky. Suitable breeding habitat appears to be extensive in Kentucky but the status of this species in cliff habitat is largely unknown. We propose to characterize the detectability and autecology of the common raven in cliff habitat and to develop protocols for monitoring the occupancy of key habitat in eastern portions of the Commonwealth. Study objectives are to: (1) quantify factors affecting the detectability of the raven in cliff habitat, (2) quantify landscape attributes of known breeding locations at multiple scales, (3) develop and initiate protocols for

monitoring the occupancy of key potential breeding habitats in Kentucky. Detectability will be estimated by conducting surveys at sites known to be occupied by ravens in the Southern Appalachians. These sites will provide the basis for a site-attribute habitat model that will quantify breeding habitat in the region. Key potential breeding habitats will be identified based on historical observations, the expertise of biologists in the Commonwealth, and on recent sighting information. Protocols for monitoring their occupancy will be based on the estimate of detectability (objective 1). We expect to generate new information for detecting breeding ravens at Kentuckyâ s cliffs and on habitat features that might be important in their occupancy of potential breeding sites. We expect to develop a consensus on where the most likely breeding locations for these species are in the Commonwealth, and to initiate a plan for their long-term periodic monitoring. Finally, we will opportunistically gather similar data on ravens discovered to nest in non-cliff habitat in the state.

Findings and status of Scientific Study or accomplishments of Science Education Activity during the reporting year (maximum 4000 characters):

Known raven breeding locations on natural cliffs were identified in Kentucky, North Carolina, Virginia, and West Virginia through coordination with biologists, naturalists, birders, and others throughout the region. A subset of these nest sites were then chosen to be visited based on accessibility, travel time, and whether the site was occupied this year. Auditory and visual surveys with binoculars and spotting scope were conducted at each known breeding sight until first detection and/or occupied detection or 2 hours had elapsed. First detection was defined as first sight/sound of a raven in the survey area, and occupied detection defined as detection of a pair or of a single individual exhibiting territorial/breeding behavior.

A total of 23 active raven breeding cliff sites were surveyed in 2009 and 2010 and used for detection probability estimation: two in KY, one in NC, 16 in VA, and four in WV. Four of these sites were visited less than three times in 2009, but were revisited in 2010 to ensure that all sites used for detectability analysis were visited at least three times. An additional five sites were visited in 2009 less than three times, but were not revisited in 2010 due to weather/time constraints or their activity status was deemed unclear.

Three cliff breeding sites in Shenandoah National Park were included in the 23 surveyed nests in 2009 and 2010. A fourth cliff nest that failed in 2009 that was not able to be surveyed again in 2010 was dropped from the detection probability analysis. Ravens were observed at many other locations within the park and additional potential cliff breeding sites were noted but not surveyed due to time constraints.

When ravens were detected at a site, the average time until first detection was 14.0 minutes, and 23.6 minutes until occupied detection. Detection probabilities for both first detection and occupied detection were calculated using SAS 9.2 software for one half hour intervals using the surveys conducted during the 2009 and 2010 breeding seasons. The detection probability for first detection ranged from 0.80 to 0.99 for a half hour and two hour survey, respectively. The detection probability for occupied detection was the same for the hour and a half and two hour intervals but lower at the half hour and one hour intervals (0.65, 0.90). These results show that ravens are highly detectable at known occupied cliff sites, suggesting a survey effort consisting of two visits each lasting one hour will enable occupancy of a given cliff site to be determined with a 95% confidence level.

We paired the number of occupied sites surveyed with an equal number of unoccupied sites which will provide the basis for a site-attribute habitat model that will quantify breeding habitat in the eastern region of Kentucky. This analysis is not yet complete as we are adding supplementary occupied and unoccupied sites through ongoing monitoring for ravens in Kentucky.

The majority of observed raven nests in the southern Appalachians are on cliffs. However, we observed and recorded habitat data for one nest located in a tree at Shenandoah National Park, Virginia, but did not include it in our detectability calculation. This nest, and particularly those reported on human constructs (e.g. radio towers, buildings, billboards, train tressels) in Appalachia, suggest that the notoriously reclusive ravens in this region appear to have become increasingly tolerant of humans and their artifacts.

Finally, based on historical observations, recent sightings, and continued communication with state ornithologists, the current list of Kentuckyâ s most probable breeding areas has been and will continue to be refined or possibly expanded to include specific monitoring sites. Using the survey effort calculated from the detection probability estimates, 25 of these specific cliff sites were surveyed during

the 2010 breeding season with additional sites planned to be surveyed in 2011.

For Scientific Studies (not Science Education Activities), were any specimens collected and removed from the park but not destroyed during analysis?

No

Funding specifically used in this park this reporting year that was provided by NPS (enter dollar amount):	**Funding specifically used in this park this reporting year that was provided by all other sources (enter dollar amount):**
$0	$500

List any other U.S. Government Agencies supporting this study or activity and the funding each provided this reporting year:

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